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(54) Title: MULTI-POSTURE CHAIR, ESPECIALLY WHEELCHAIR, WITH MEANS TO ASSIST STANDING		
(57) Abstract <p>An adjustable chair, particularly a wheelchair, is described having a footrest (13) which can be moved rearwardly to a position between the wheels (11, 12). The seat (14) can be tilted to raise the occupant towards a standing position. The chair includes a main frame (10) and a sub-frame comprising a seat frame (39) pivotally connected to a back frame (40) carrying seat back (16). A control mechanism (17) is operable to tilt the seat (14) by raising the back frame (40) which is coupled to the frame (10) by upper and lower links (44, 45). The footrest (13) is coupled to the frame (10) by toe arms (27) and heel arms (28), the toe arms (27) being drivable by footrest drive means (22). A torso harness restrains the occupant in the standing position and knee supporting means (55) prevents buckling of the knees. Chair drive means (18) includes a drive actuator (19) which is raised with the seat (14) so a standing occupant can drive the wheelchair.</p> <div data-bbox="925 1260 1429 1785" data-label="Image"> </div>		

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This invention relates to adjustable chairs of the kind that can be arranged to support an occupant in any one of several postures. The invention is particularly suited for use with wheelchairs which can support an occupant in either a seated position or a generally upright or standing position. It will be convenient to hereinafter describe the invention with particular reference to wheelchairs.

10 Paraplegics and other people who are temporarily or permanently confined to wheelchairs suffer psychologically and physically from inability to adopt a standing or near standing position. It is a psychological benefit for the person concerned to be able to attain a height comparable to that of a person having full ambulatory capability. The physical benefit of being able to adopt a standing or near standing position is that some load must be placed on the legs to avoid osteomalacia and pressure sores.

20 A wheelchair has been known in which the seat can be pivoted and the back can be raised so as to raise the occupant to a standing position over the footrest, which is generally located slightly forward of the front wheels. That adjustment results in some instability of the wheelchair so it is generally necessary to provide and operate a ground engaging member in front of the footrest before the occupant is raised to the standing position. A further disadvantage of such a wheelchair is that, when the occupant is raised to the standing position he is no longer able to actuate the mechanism for driving the wheelchair. The resulting loss of mobility is a serious disadvantage to the occupant.

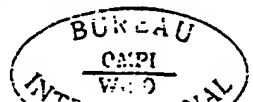
30 It is a principal object of the present invention to provide a chair having improved mechanism for adjusting its



support characteristics so that an occupant may be supported in any one of a plurality of postures. It is a further object of the invention in one form to provide a wheelchair having the foregoing mechanism and which does not require additional ground support when adjusted to support the occupant upright. Still another object of the invention is to provide such a wheelchair which can be driven by the occupant whilst in any of the support positions provided by that chair.

10 According to the present invention there is provided an adjustable chair including a main frame having front and rear ground engaging means, a footrest and a seat, characterized in that the footrest is selectively movable relative to the main frame between a sitting position and a rearwardly displaced standing position in which the footrest is located between the front and rear ground engaging means and said seat is selectively tiltable relative to the main frame to raise an occupant towards a standing position. As a result of the movement of the footrest to the standing position between the front and rear ground engaging zones any weight applied to the footrest does
20 not disturb the chair's stability. Reference throughout this specification to adoption of an upright or standing position is to be interpreted broadly since a wheelchair occupant may not be able to adopt a true standing position under any circumstances. For such situations the posture of the occupant will be near upright or partially standing and the specification is to be read accordingly.

30 The adjustable chair preferably includes a linkage arrangement between the footrest and the main frame and also includes a footrest drive means for selectively driving the footrest between its sitting and standing positions, the footrest



drive means being operable between the main frame and the linkage arrangement.

In the preferred arrangement the chair includes a sub-frame carried by the main frame, the sub-frame being selectively tiltable relative to the main frame and the seat being mounted to the sub-frame. A control mechanism is operable between the sub-frame and main frame so as to enable selective adjustment of the angle of tilt of the seat relative to the main frame.

10 The chair preferably also includes a chair back mounted to the sub-frame and pivotable relative to the seat so as to remain generally upright throughout the tilting movement of the seat.

Restraining means may be provided to prevent the occupant sliding from the chair as he is raised towards the standing position, the restraining means including a torso harness for restraining the occupant's torso and transverse knee supporting means to prevent the occupant's knees buckling in the standing position.

20 When the invention is embodied in a wheelchair, the front and rear ground engaging means are wheels and the wheelchair preferably includes a chair drive means including a drive actuator operable by the occupant to cause at least one of the wheels to receive a driving force, the drive actuator being movable with tilting of the seat so as to enable operation of the drive means by the occupant when in the standing position.

The present invention will now be described as applied to a wheelchair and with reference to the accompanying drawings, in which:

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Figures 1 to 4 illustrate schematically four possible support positions provided by a wheelchair embodying the present invention,

Figure 5 shows a vertical section through a chair according to a preferred embodiment of the present invention,

Figure 6 shows the chair of Figure 5 in its standing position, and

Figure 7 shows schematically the wheel drive arrangement.

10 The wheelchair illustrated in the drawings includes a main frame 10 having front and rear ground engaging wheels 11, 12. The front wheels 11 are small swivel castor wheels and the rear wheels 12 are relatively large drivable wheels. The rear wheels 12 may be independently sprung relative to the main frame 10 to reduce shocks transmitted to the chair occupant by movement over uneven surfaces particularly when in the standing position (Figures 2 and 6) since in this position any cushioning of the seat is ineffective. Independently sprung rear wheels 12 also enable better grip on uneven surfaces.

20 Also the rear wheels 12 may be provided with a selectively operable ratchet mechanism (not shown) to prevent the chair rolling backwards if the occupant wishes to rest on a slope. This may be desirable since it is expected that the wheelchair embodying the present invention will be heavier than the folding wheelchairs commonly in use.

30 The wheelchair also includes a footrest 13 and a seat 14. The footrest 13 is selectively movable relative to the main frame 10 between a sitting position (Figure 1) and a rearwardly displaced standing position (Figures 2 and 6) in which the footrest 13 is located between the front and rear wheels

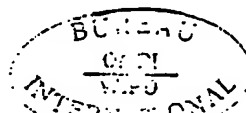


11,12 and the seat 14 is selectively tiltable relative to the main frame 10 to raise an occupant towards a standing position (Figures 2 and 6).

A sub-frame 15 is carried by the main frame 10, the sub-frame 15 being selectively tiltable relative to the main frame 10 and the seat 14 being mounted to the sub-frame 15. A chair back 16 is mounted to the sub-frame 15 and is pivotable relative to the seat 14 so as to remain generally upright throughout the tilting movement of the seat 14. A control mechanism 17 is operable between the sub-frame 15 and main frame 10 so as to enable selective adjustment of the angle of tilt of the seat 14 relative to the main frame 10.

The wheelchair also includes a chair drive means 18 (Figure 7) including a drive actuator 19 operable by the occupant to cause at least one of the rear wheels 12 to receive a driving force, the drive actuator 19 being movable with tilting of the seat 14 so as to enable operation of the drive means 18 by the occupant when in the standing position.

The chair main frame 10 may be generally U-shaped in plan with the opening in the U towards the front of the chair. In the case of the illustrated embodiment of a wheelchair, the frame 10 has the wheels 11,12 mounted thereto at the front and back of the chair. The frame comprises a pair of longitudinal laterally spaced parallel side bars 20 extending from the front wheels 11 to the back wheels 12 and a cross bar (not shown) connecting the side bars 20 in the vicinity of the back wheels 12. A front post (not shown) may be provided extending upwardly from the forward end of each side bar 20, the top of each post being joined to the rear end of the associated side bar 20 by a respective diagonal frame bar 21.



The wheelchair includes footrest drive means 22 for selectively driving the footrest 13 between its sitting and standing positions. The sitting position of the footrest 13 is shown in Figure 1 at or in front of the front wheels 11 and the footrest 13 in its standing position is located between the front and back wheels 11,12. The wheelchair includes a linkage arrangement 23 for supporting the footrest 13 and maintaining the footrest 13 at a comfortable inclination for the occupant throughout its range of movement. The footrest 13 may be of any suitable configuration such as a generally rectangular footplate 24 having a forward toe end 25 and a rear heel end 26. The toe end 25 of the footplate 24 is slightly higher than the heel end 26 in its sitting position and vice versa when the footplate 24 is drawn back to the standing position before the occupant is raised to the standing position. The footrest 13 is selectively movable to a forward elevated position (Figure 3) in front of the sitting position in which the toe end 25 is markedly higher than the heel end 26, enabling a change of leg position for comfort and to provide ready access for an attendant to the occupant's feet or shoes.

As shown in Figures 5 and 6, the linkage arrangement 23 includes a toe arm 27 and a heel arm 28 at each side of the footplate 24, each toe arm 27 being pivotally connected at its lower end 29 to the toe end 25 of the footplate 24 and pivotally connected at its upper end 31 to the diagonal frame bar 21 of the main frame 10. Each heel arm 28 is pivotally connected at its lower end 30 to the heel end 26 of the footplate 24 and is pivotally connected at its upper end 32 either directly or indirectly to the main frame 10, the indirect connection being illustrated and described later.



The footrest drive means 22 is operable between the main frame 10 and the linkage arrangement 23. In the embodiment of Figures 5 and 6 one toe arm 27 is drivable about its upper end's pivotal connection 31 to the frame 10 to thereby move the footrest 13. The toe arm 27 may be drivable through about 120° of arc. The toe arm 27 is provided with a crank extension 33 at its upper end and coupled to the drive means 22 for driving the toe arm 27 about pivotal point 31. The drive means 22 includes a drive mechanism including the crank extension 33 of the toe arm 27 as one element thereof. For driving the drive mechanism there is provided a drive screw 34 mounted near the upper forward end of one diagonal frame bar 21 and having a manually operable drive crank handle 35a within reach of the occupant. The drive screw 34 is operatively associated with a nut 35, the nut 35 providing the driving point of the drive mechanism. The drive mechanism further includes a pivoting arm 36 having one end pivotally connected to the frame at point 37 spaced from the connection point 31 of the driven toe arm 27 to the frame. The other end of the pivoting arm 36 is coupled to the nut 35 so that the nut 35 moves in an arc about the point 37 where the pivoting arm 36 is connected to the frame 10. A drive link 38 is also provided from the pivoting arm 36 to the crank extension 33 of the driven toe arm 27. With this arrangement, winding of the drive screw 34 by means of the handle 35a moves the nut 35 up and down the screw 34 and carries with it one end of the drive link 38 so that the toe arm 27 is pivoted about its connection 31 to the frame 10 by means of the crank extension 33.

Instead of the drive mechanism and screw 34, it is possible to use a worm and either a worm wheel sector of at



least 120° or a complete wheel.

The footrest drive means 22, instead of the mechanical arrangement described above, may be hydraulically operated possibly using a hydraulic pump and cylinder or it may be electrically operated possibly driving the footrest linkage shaft 31 by a gear drive.

10 The control mechanism 17 of the chair according to the present invention is selectively operable to tilt the seat 14 relative to the main frame 10 to raise the occupant towards the standing position. The sub-frame 15 includes a seat frame 39 on which the seat 14 is mounted and a back frame 40 on which the chair back 16 is mounted. The back frame 40 is provided with arm rests 41 for the occupant. The seat and back mounting frames 39, 40 are pivotally connected together at a point 42 at each side of the chair, the two points 42 being approximately in line with the hip joint of the occupant so that as the seat 14 and back 16 are raised to the standing position the occupant does not slide substantially relative to the seat 14 or back frame 40.

20 The chair further includes a back frame linkage arrangement 43 mounting the back frame 40 to the main frame 10 for selective relative movement, the back frame linkage arrangement including a quadrilateral linkage arrangement which includes an upper link 44 and a lower link 45, each being pivotally connected at its forward end to the main frame 10 and pivotally connected at its rear end to the back frame 40 and arranged so that during movement of the back frame linkage arrangement 43 the chair back 16 is maintained generally upright and the seat 14 mounted on the seat frame 39 is tilted between a generally horizontal sitting position and a generally upright standing position. The chair back 16 is mounted so as to be slidable

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generally vertically on the back frame 40, the chair back 16 being coupled to the seat frame 39 by a back link 46 pivotally connected at one end to the chair back 16 and at its other end to the seat frame 39 and operable to raise the chair back 16 relative to the back frame 40 as the seat 14 is tilted towards the standing position and thereby maintain the lower edge of the chair back 16 spaced from the rear edge of the seat 14. This will prevent pinching of the gluteal muscles of the occupant.

10 The seat also includes a control mechanism 17 operative for driving the seat 14 between the sitting and standing positions. The mechanism 17 may be electrically operated and may include a suitable motor for driving mechanical components such as hydraulic rams to raise and lower the seat 14. Alternatively the mechanism 17 may include a hydraulic system operable from a lever accessible to the occupant and arranged to supply hydraulic fluid to a ram operable between the main frame 10 and a point located say in the centre of the rear side of the back frame 40.

20 However in the arrangement illustrated in Figures 5 and 6, the mechanism 17 includes a drive screw 47 mounted at one side of the seat 14 and extending generally vertically. The drive screw 47 has a crank handle 48 at its upper end and is mounted to the back frame 40 in the vicinity of the arm rest 41 of the chair so that the occupant can readily operate the drive screw 48. The drive screw 48 is operatively associated with a nut 49 of nut tube 50 which is pivoted to the frame 10 so that as the drive screw 47 is operated the back frame 40 is driven between the sitting and standing positions.

30 The footrest 13 is connected to the seat 14 adjacent to its front edge 51 so that a constant distance between the footrest 13 and a region at the seat front is maintained so that



the occupant's thighs are not raised from the seat 14 or the feet are not raised from footrest 13 during movement of the seat 14. To achieve this movement of the footrest 13 there is provided at each side of the seat 14 a calf arm 52 extending generally along the line of the occupant's calves and being pivotally connected at its upper end to a respective part 53 of the seat frame 39 extending forwardly of the front edge 51 of the seat 14. Preferably this pivotal connection is provided approximately in line with the knee joints of the occupant. Each calf arm 52 is also pivotally connected at its lower end to the footrest 13 between the toe and heel arms 27,28 and preferably in line with the occupant's ankle joints so that as the footrest 13 pivots, the distance from the footrest 13 to the knee joint is maintained substantially constant.

In the embodiment of Figures 5 and 6 each heel arm 28 is pivotally connected at its lower end 30 to the heel end 26 of the footplate 24 and is pivotally connected at its upper end 32 to an extension 54 of the forward end of the respective lower link 45, the extension 54 projecting forwardly of the pivotal connection of the lower link 45 to the diagonal frame bar 21 of the main frame 10 so that as the seat 14 is tilted the heel end 26 of the footplate 24 pivots to a small extent about the toe end 25 thereof to maintain the footplate 24 in a plane comfortable to the occupant. The length of each extension 54 of the respective lower link 45 and the location of the pivotal mounting 32 of each heel arm 28 to the extension 54 must be chosen carefully to enable the desired pivoting movement of the footplate 24 to occur. With this arrangement, as mentioned earlier the heel is slightly above the toe when the footplate 24 is rearwardly displaced from the sitting position to the standing



position between the wheels 11, 12 and as the seat 14 is tilted upwardly, the heel arms 28 cause the heel end 26 of the footplate 24 to be lowered to a generally horizontal position as the standing position of the seat 14 is reached. Restraining means is provided to prevent the occupant sliding from the chair as he is raised towards the standing position, the restraining means including a torso harness (not shown) for restraining the occupant's torso and transverse knee supporting means 55 to prevent the occupant's knees buckling in the standing position.

10 The torso harness may include a lap and sash belt or full safety harness similar to that provided in a motor vehicle. Posts 56 may be provided extending upwardly from the back frame 40 to provide mountings for the upper end of the sash or shoulder straps of the harness. The knee supporting means 55 includes a knee stop 57 extending across the knee caps of the occupant and being selectively removable from its mounting. The knee stop 57 is shown as a plate extending between respective forwardly directed extensions 58 on the upper ends of the calf arms 52.

The drive means 18 includes a drive actuator 19

20 raisable with the seat 14 so that the occupant can comfortably operate the chair drive means 18 when in the standing position. The chair drive means 18 may be electrically operated in which case the actuator 19 within reach of the occupant may be readily provided on the arm rest 41 of the chair. However, as shown in Figure 7 the chair drive means 18 may include a chain and sprocket drive arrangement. A pair of handwheels 60, one for each rear wheel 12, may be mounted to the back frame 40 one at each side of the chair so that the handwheels 60 are raised and lowered with the chair back 16. The handwheels 60 are associated with

30 driving sprockets 61 and drive chains 62 and 66 which couple the



driving sprockets 61 via a layshaft and sprocket 64 to driven sprockets 63 operatively associated with the back wheels 12 of the wheelchair. The chains 62 extend between the driving and the layshaft sprockets 61,64. A second chain drive 66 extends between the layshaft driving sprockets 64 and the driven sprockets 63. During movement of the seat 14 the layshaft moves relative to the chair frame 10 to maintain the chain path lengths constant. The chains 62 and 66 may be adjustable by means of idler sprockets (not shown) which can be selectively engaged or disengaged with the chains between the driven and driving sprockets 61,63 to take up any slack in the chains in any convenient manner or by having the centre distance of the chain drives adjustable. Chain guards 65 are also provided and the layshaft can be supported by the chain guards 65.

Preferably there is provided a brake (not shown) operatively associated with the rear wheels 12 of the chair. Preferably the brake is operable by the occupant when in the standing position as well as in the sitting position. Accordingly the brake may include a manually operable brake engagement handle associated with one of the arm rests 41 of the chair. The brake engagement handle may be connected to the braking means associated with the rear wheels 12 of the chair via Bowden cables.

In use of the preferred embodiment of the present invention illustrated in the drawings it has been found that the linkage arrangements 23,43 for the footrest 13 and seat 14 enable the chair to be tilted backwardly from the sitting position where the seat 14 is generally horizontal and when the footrest 13 in its forward elevated position so that a further tilted position (Figure 3) is selectable by the occupant for relieving



discomfort. It has also been found that by moving the footrest 13 to the forward elevated position in front of the sitting position thereof and then operating the means 17 for raising the back 16 and the seat 14 enables the seat 14 and back 16 to move to a high seated position with the seat 14 and back 16 remaining generally in their relative positions as they are in the sitting position. This provides a further position for the occupant, namely a high seated position shown in Figure 4.

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CLAIMS

1. An adjustable chair including a main frame having front and rear ground engaging means, a footrest and a seat, characterised in that the footrest is selectively movable relative to the main frame between a sitting position and a rearwardly displaced standing position in which the footrest is located between the front and rear ground engaging means and said seat is selectively tiltable relative to the main frame to raise an occupant towards a standing position.

10 2. An adjustable chair according to Claim 1 and characterized by a linkage arrangement between the footrest and main frame, said footrest including a footplate having a forward toe end and a rear heel end and said linkage arrangement including a toe arm and a heel arm at each side of the footplate, each toe arm being pivotally connected at its lower end to the toe end of the footplate and pivotally connected at its upper end to the main frame, each heel arm being pivotally connected at its lower end to the heel end of the footplate and pivotally connected at its upper end either directly or indirectly to the
20 main frame.

3. An adjustable chair according to Claim 2 and characterized by footrest drive means for selectively driving the footrest between its sitting and standing positions, the footrest drive means being operable between the main frame and the linkage arrangement.

4. An adjustable chair according to Claim 1 characterized in that the footrest is connected to the seat adjacent to the front edge thereof so that a substantially constant distance is maintained between the footrest and a region at the seat front
30 edge.

5. An adjustable chair according to Claim 1 characterized in that the footrest has a forward toe end and a rear heel end and is selectively movable from the sitting position thereof to a forward elevated position in which the toe end is markedly higher than the heel end.

6. An adjustable chair according to Claim 1 and characterised by a sub-frame carried by the main frame, the sub-frame being selectively tiltable relative to the main frame and the seat being mounted to the sub-frame.

10 7. An adjustable chair according to Claim 6 and characterized by a control mechanism operable between the sub-frame and main frame so as to enable selective adjustment of the angle of tilt of the seat relative to the main frame.

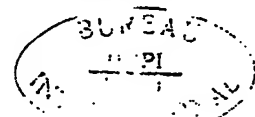
8. An adjustable chair according to Claim 7 and characterized by a chair back mounted to the sub-frame and pivotable relative to the seat so as to remain generally upright throughout the tilting movement of the seat.

9. An adjustable chair according to Claim 8 characterized in that the sub-frame includes a seat frame on which the seat is mounted and a back frame on which the chair back is mounted so as to be slidable generally vertically of the back frame, the chair back being coupled to the seat frame by a back link pivotally connected at one end to the chair back and at its other end to the seat frame and operable to raise the chair back relative to the back frame as the seat is tilted towards the standing position and thereby maintain the lower edge of the chair back spaced from the rear edge of the seat.

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10. An adjustable chair according to Claim 8 and characterized in that the sub-frame includes a seat frame on which the seat is mounted and a back frame on which the chair back is

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mounted, the chair further including a back frame linkage arrangement mounting the back frame to the main frame for selective relative movement, the back frame linkage arrangement including a quadrilateral linkage arrangement which includes an upper link and a lower link each being pivotally connected at its forward end to the main frame and pivotally connected at its rear end to the back frame and arranged so that during movement of the back frame linkage arrangement the chair back is maintained generally upright and the seat mounted on the seat frame is tilted between a generally horizontal sitting position and a generally upright standing position.

11. An adjustable chair according to Claim 10 and characterized by a linkage arrangement between the footrest and main frame, said footrest including a footplate having a forward toe end and a rear heel end and said linkage arrangement including a toe arm and a heel arm at each side of the footplate, each toe arm being pivotally connected at its lower end to the toe end of the footplate and pivotally connected at its upper end to the main frame, each heel arm being pivotally connected at its lower end to the heel end of the footplate and pivotally connected at its upper end to an extension of the forward end of the respective lower link, the extension projecting forwardly of the pivotal connection of the lower link to the main frame so that as the seat is tilted the heel end of the footplate pivots to a small extent about the toe end thereof to maintain the footplate in a plane comfortable to the occupant.

12. An adjustable chair according to any one preceding claim and characterized by restraining means to prevent the occupant sliding from the chair as he is raised towards the



standing position, the restraining means including a torso harness for restraining the occupant's torso and transverse knee supporting means to prevent the occupant's knee buckling in the standing position.

13. A wheelchair including an adjustable chair according to any one of Claims 1 to 11, said front and rear ground engaging means being wheels and characterized by a chair drive means including a drive actuator operable by the occupant to cause at least one of the wheels to receive a driving force, the drive actuator being movable with tilting of the seat so as to enable operation of the drive means by the occupant when in the standing position.

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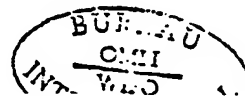
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AMENDED CLAIMS

(received by the International Bureau on 22 February 1982 (21.02.82))

(amended) "AN ADJUSTABLE CHAIR INCLUDING A MAIN FRAME HAVING FRONT AND REAR GROUND ENGAGING MEANS, A FOOTREST AND A SEAT, CHARACTERISED BY A LINKAGE ARRANGEMENT BETWEEN THE FOOTREST AND MAIN FRAME OR BETWEEN THE SEAT AND THE MAIN FRAME; THE FOOTREST BEING SELECTIVELY MOVABLE RELATIVE TO THE MAIN FRAME BETWEEN A SITTING POSITION AND A REARWARDLY DISPLACED STANDING POSITION IN WHICH THE FOOTREST IS LOCATED BETWEEN THE FRONT AND REAR GROUND ENGAGING MEANS, SAID SEAT BEING SELECTIVELY TILTABLE RELATIVE TO THE MAIN FRAME TO RAISE AN OCCUPANT TOWARDS A STANDING POSITION, THE FOOTREST STANDING POSITION BEING POSITIONED SUCH THAT WHEN THE OCCUPANT STANDING POSITION IS APPROACHED OR ATTAINED, THE FOOTREST WILL SUPPORT THE OCCUPANT CLEAR OF THE GROUND AND IN SUCH A POSITION AS TO GIVE ADEQUATE STABILITY FOR MOBILITY OF THE CHAIR AND ITS OCCUPANT."



10 2. An adjustable chair according to Claim 1 and
characterized by a linkage arrangement between the footrest and
main frame, said footrest including a footplate having a forward
toe end and a rear heel end and said linkage arrangement
including a toe arm and a heel arm at each side of the footplate,
each toe arm being pivotally connected at its lower end to the
toe end of the footplate and pivotally connected at its upper
end to the main frame, each heel arm being pivotally connected
at its lower end to the heel end of the footplate and pivotally
connected at its upper end either directly or indirectly to the
20 main frame.

3. An adjustable chair according to Claim 2 and
characterized by footrest drive means for selectively driving
the footrest between its sitting and standing positions, the
footrest drive means being operable between the main frame and
the linkage arrangement.

4. An adjustable chair according to Claim 1 characterized
in that the footrest is connected to the seat adjacent to the
front edge thereof so that a substantially constant distance
is maintained between the footrest and a region at the seat front
30 edge.



5. An adjustable chair according to Claim 1 characterized in that the footrest has a forward toe end and a rear heel end and is selectively movable from the sitting position thereof to a forward elevated position in which the toe end is markedly higher than the heel end.

6. An adjustable chair according to Claim 1 and characterised by a sub-frame carried by the main frame, the sub-frame being selectively tiltable relative to the main frame and the seat being mounted to the sub-frame.

10 7. An adjustable chair according to Claim 6 and characterized by a control mechanism operable between the sub-frame and main frame so as to enable selective adjustment of the angle of tilt of the seat relative to the main frame.

8. An adjustable chair according to Claim 7 and characterized by a chair back mounted to the sub-frame and pivotable relative to the seat so as to remain generally upright throughout the tilting movement of the seat.

20 9. An adjustable chair according to Claim 8 characterized in that the sub-frame includes a seat frame on which the seat is mounted and a back frame on which the chair back is mounted so as to be slidable generally vertically of the back frame, the chair back being coupled to the seat frame by a back link pivotally connected at one end to the chair back and at its other end to the seat frame and operable to raise the chair back relative to the back frame as the seat is tilted towards the standing position and thereby maintain the lower edge of the chair back spaced from the rear edge of the seat.

30 10. An adjustable chair according to Claim 8 and characterized in that the sub-frame includes a seat frame on which the seat is mounted and a back frame on which the chair back is



mounted, the chair further including a back frame linkage arrangement mounting the back frame to the main frame for selective relative movement, the back frame linkage arrangement including a quadrilateral linkage arrangement which includes an upper link and a lower link each being pivotally connected at its forward end to the main frame and pivotally connected at its rear end to the back frame and arranged so that during movement of the back frame linkage arrangement the chair back is maintained generally upright and the seat mounted on the seat frame is tilted between a generally horizontal sitting position and a generally upright standing position.

11. An adjustable chair according to Claim 10 and characterized by a linkage arrangement between the footrest and main frame, said footrest including a footplate having a forward toe end and a rear heel end and said linkage arrangement including a toe arm and a heel arm at each side of the footplate, each toe arm being pivotally connected at its lower end to the toe end of the footplate and pivotally connected at its upper end to the main frame, each heel arm being pivotally connected at its lower end to the heel end of the footplate and pivotally connected at its upper end to an extension of the forward end of the respective lower link, the extension projecting forwardly of the pivotal connection of the lower link to the main frame so that as the seat is tilted the heel end of the footplate pivots to a small extent about the toe end thereof to maintain the footplate in a plane comfortable to the occupant.

12. An adjustable chair according to any one preceding claim and characterized by restraining means to prevent the occupant sliding from the chair as he is raised towards the



standing position, the restraining means including a torso harness for restraining the occupant's torso and transverse knee supporting means to prevent the occupant's knee buckling in the standing position.

13. A wheelchair including an adjustable chair according to any one of Claims 1 to 11, said front and rear ground engaging means being wheels and characterized by a chair drive means including a drive actuator operable by the occupant to cause at least one of the wheels to receive a driving force, the drive actuator being movable with tilting of the seat so as to enable operation of the drive means by the occupant when in the standing position.

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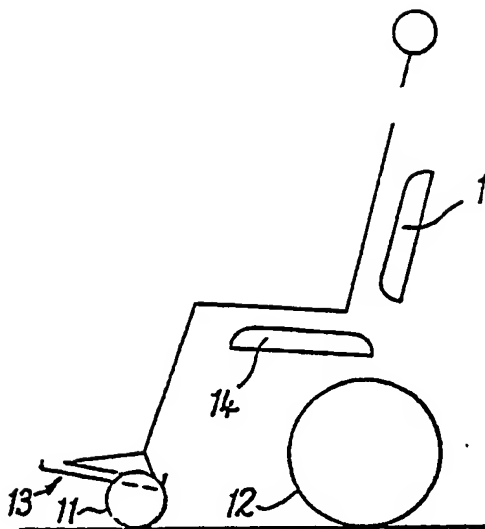


FIG. 1

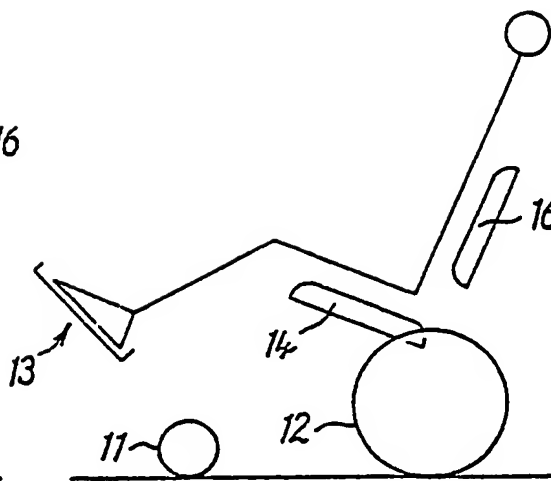


FIG. 3

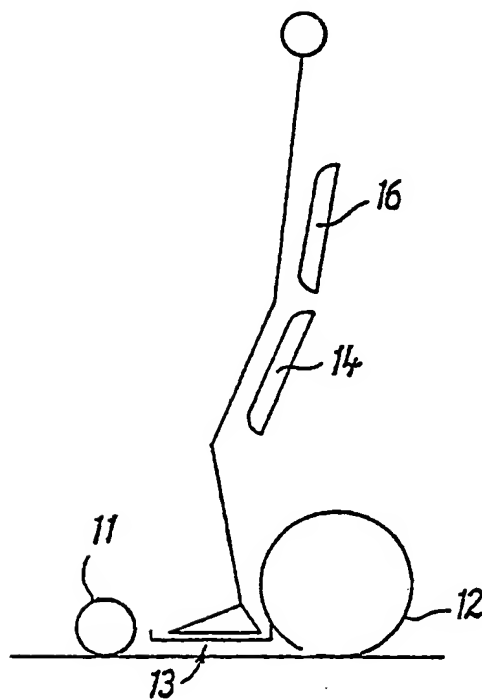


FIG. 2

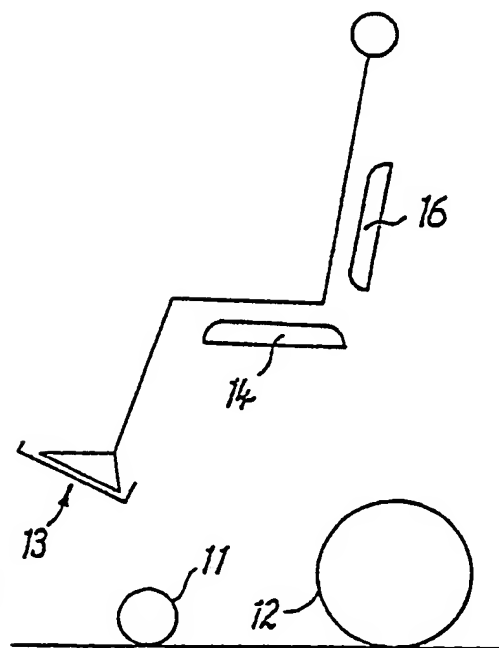


FIG. 4

FIG. 5

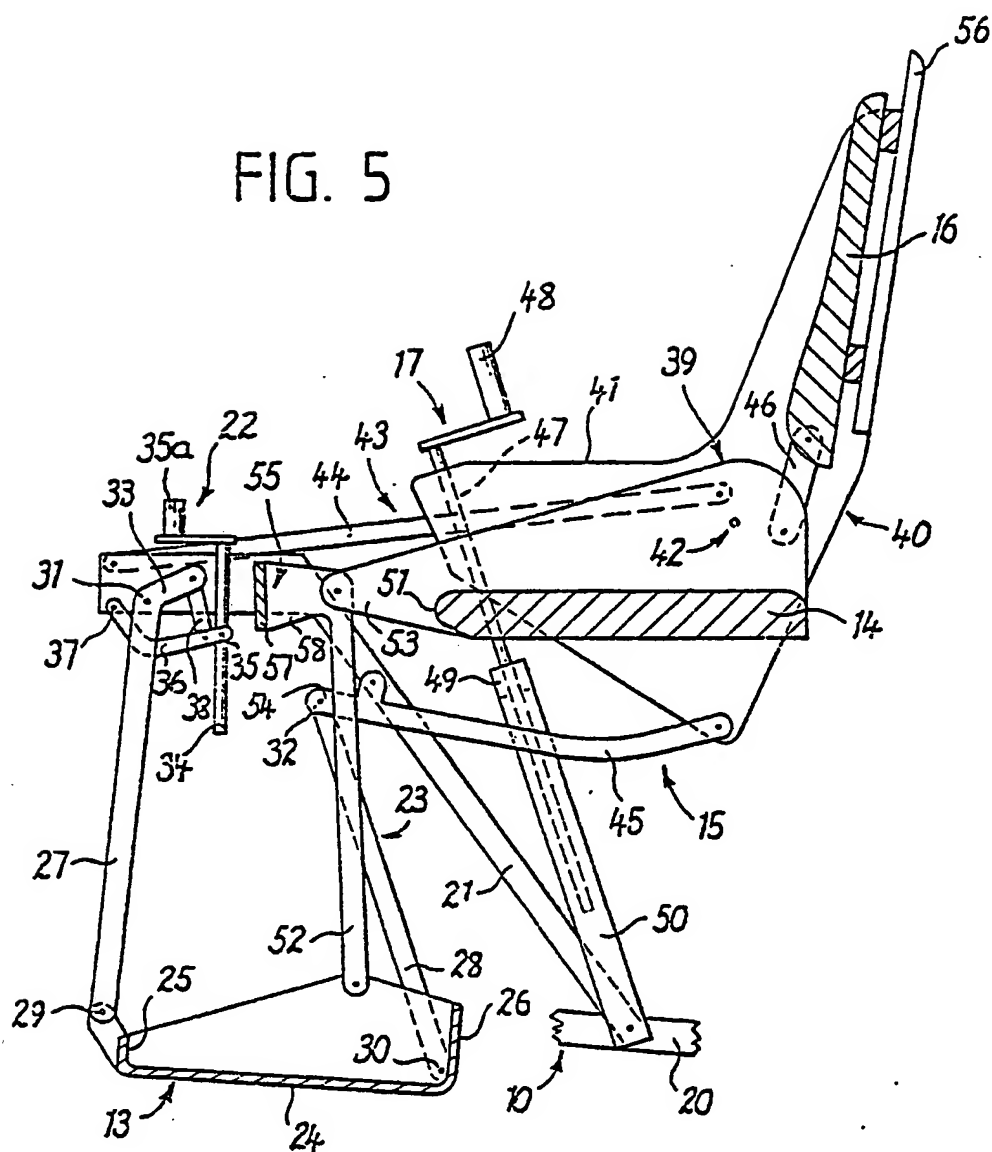


FIG. 7

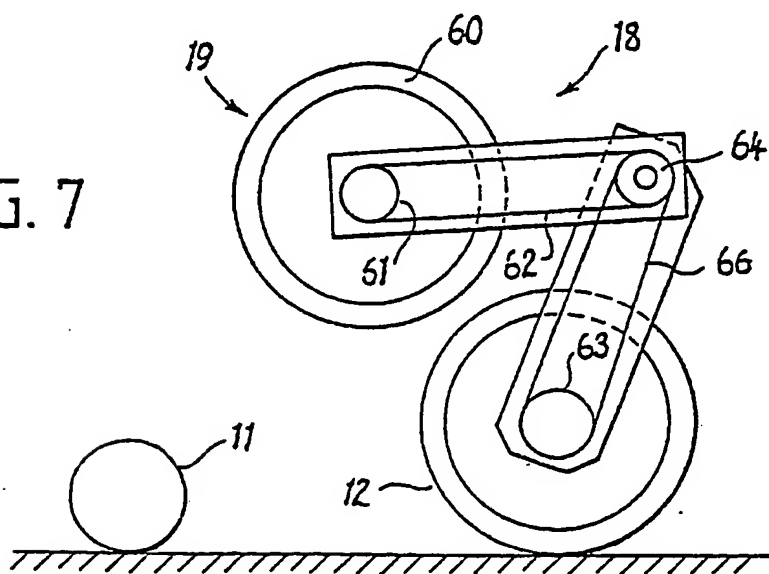
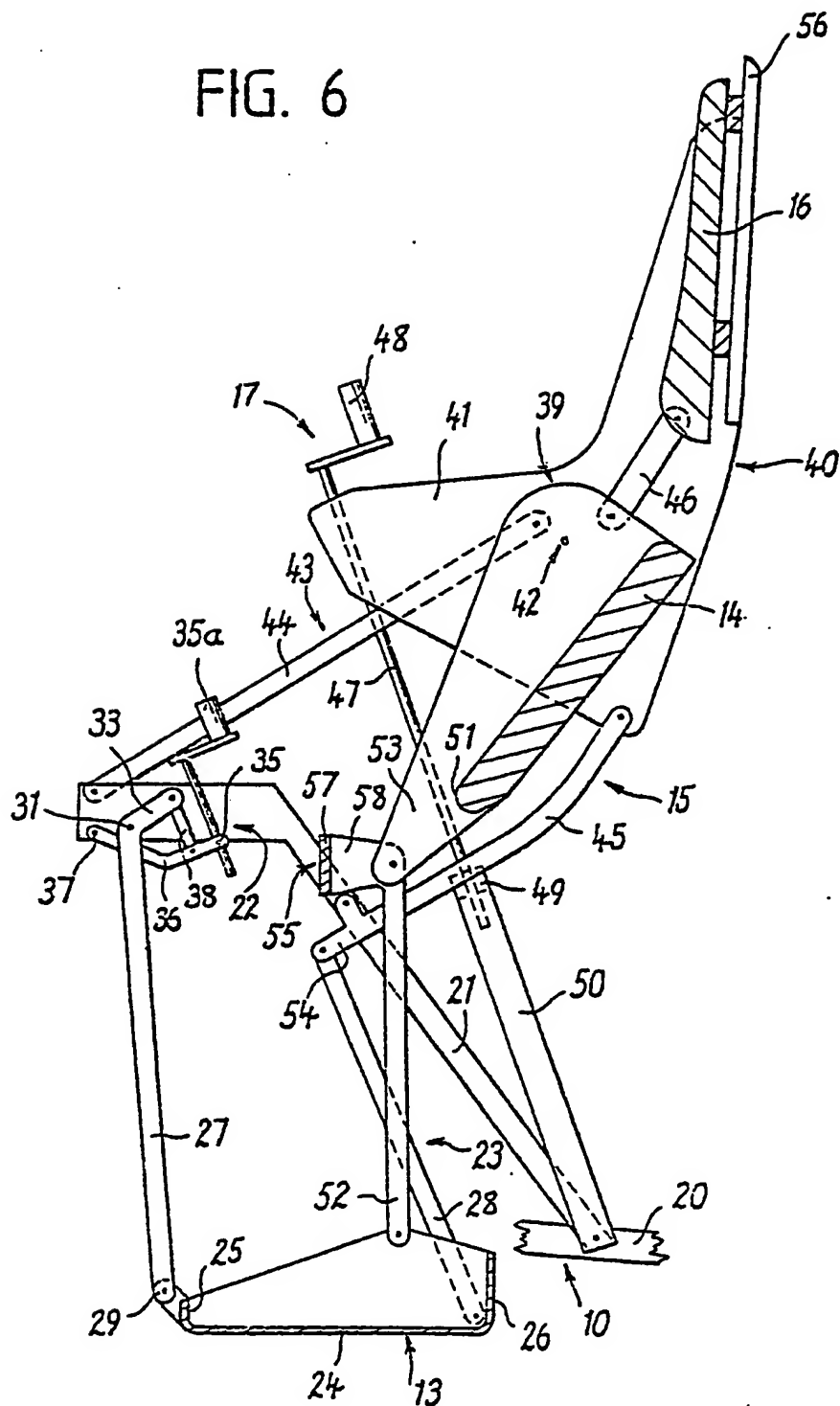


FIG. 6



SUBJECTIVE SHEET



INTERNATIONAL SEARCH REPORT

International Application No **PCT/AU81/00151**

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ³ According to International Patent Classification (IPC) or to both National Classification and IPC <div style="font-size: 1.2em; margin-top: 5px;">Int. Cl³ A61G 5/00, 5/02, 5/04</div>																													
II. FIELDS SEARCHED <div style="text-align: center; margin-top: 5px;">Minimum Documentation Searched ⁴</div> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%; border: none;">Classification System</td> <td style="border: none;">Classification Symbols</td> </tr> <tr> <td style="border: none; text-align: center; padding-top: 10px;">IPC</td> <td style="border: none; padding-top: 10px;">A61G 5/00, 5/02, 5/04 A47C 7/56</td> </tr> </table> <div style="text-align: center; margin-top: 10px; font-size: 0.8em;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵</div> <div style="margin-top: 20px;">AU: IPC as above</div>			Classification System	Classification Symbols	IPC	A61G 5/00, 5/02, 5/04 A47C 7/56																							
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III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; text-align: center;">Category ⁶</th> <th style="width: 70%; text-align: center;">Citation of Document, ¹⁵ with indication, where appropriate, of the relevant passages ¹⁷</th> <th style="width: 20%; text-align: center;">Relevant to Claim No. ¹⁸</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Y</td> <td>US,A, 3343871 (YATES et al) 26 September 1967 (26.09.67)</td> <td></td> </tr> <tr> <td style="text-align: center;">X</td> <td>US,A, 3589769 (BRESSLER) 29 June 1971 (29.06.71)</td> <td></td> </tr> <tr> <td style="text-align: center;">Y</td> <td>US,A, 3851917 (HORSTMANN) 3 December 1974 (03.12.74)</td> <td></td> </tr> <tr> <td style="text-align: center;">X</td> <td>US,A, 3907051 (WEANT et al) 23 September 1975 (23.09.75)</td> <td></td> </tr> <tr> <td style="text-align: center;">X</td> <td>US,A, 4076304 (DEUCHER) 28 February 1978 (28.02.78)</td> <td></td> </tr> <tr> <td style="text-align: center;">Y</td> <td>GB,A, 1237808 (VAN RHYN) 30 June 1971 (30.06.71)</td> <td></td> </tr> <tr> <td style="text-align: center;">X</td> <td>AU,B, 44652/68 (430169) (HODGE INVESTMENTS P.L.) 22 April 1981 (22.04.81) (& GB,A, 1264969)</td> <td></td> </tr> <tr> <td style="text-align: center;">Y</td> <td>GB,A, 1337807 (WRETHANDER) 21 November 1973 (21.11.73)</td> <td></td> </tr> </tbody> </table> <div style="margin-top: 10px; font-size: 0.8em;"> <p>⁶ Special categories of cited documents: ¹⁸</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> </div> <div style="width: 45%;"> <p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance</p> </div> </div> </div>			Category ⁶	Citation of Document, ¹⁵ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸	Y	US,A, 3343871 (YATES et al) 26 September 1967 (26.09.67)		X	US,A, 3589769 (BRESSLER) 29 June 1971 (29.06.71)		Y	US,A, 3851917 (HORSTMANN) 3 December 1974 (03.12.74)		X	US,A, 3907051 (WEANT et al) 23 September 1975 (23.09.75)		X	US,A, 4076304 (DEUCHER) 28 February 1978 (28.02.78)		Y	GB,A, 1237808 (VAN RHYN) 30 June 1971 (30.06.71)		X	AU,B, 44652/68 (430169) (HODGE INVESTMENTS P.L.) 22 April 1981 (22.04.81) (& GB,A, 1264969)		Y	GB,A, 1337807 (WRETHANDER) 21 November 1973 (21.11.73)	
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IV. CERTIFICATION <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Date of the Actual Completion of the International Search ¹</td> <td style="width: 50%; border: none;">Date of Mailing of this International Search Report ²</td> </tr> <tr> <td style="border: none; text-align: center;">7 December 1981 (07.12.81)</td> <td style="border: none; text-align: center;">22 DECEMBER 1981 (82-12-8)</td> </tr> <tr> <td style="border: none;">International Searching Authority ¹</td> <td style="border: none;">Signature of Authorized Officer ²⁰</td> </tr> <tr> <td style="border: none; text-align: center;">Australian Patent Office</td> <td style="border: none; text-align: center;">D.B. CUPITT</td> </tr> </table>			Date of the Actual Completion of the International Search ¹	Date of Mailing of this International Search Report ²	7 December 1981 (07.12.81)	22 DECEMBER 1981 (82-12-8)	International Searching Authority ¹	Signature of Authorized Officer ²⁰	Australian Patent Office	D.B. CUPITT																			
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Australian Patent Office	D.B. CUPITT																												

~~FOR OTHER INFORMATION, CONTINUED FROM THE FIRST SHEET~~
~~(Not to be published)~~

111. Documents Considered to be Relevant (Continued
 from Second Sheet)

- Y GB,A, 1406420 (LYNWOOD) 17 September 1975
 (17.09.75)
- Y GB,A, 1407033 (COBURN et al) 24 September
 1975 (24.09.75)
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 (05.09.79)
- Y GB,A, 1277210 (BATH INSTITUTE OF MEDICAL
 ENGINEERING) 7 June 1972 (07.06.72)
- Y US,A, 3806194 (KOLEBARA) 23 April 1974
 (23.04.74)
- Y US,A, 3463146 (SCHWARTZ et al) 22 August 1969
 (26.08.69)